



# Comparative Performance of Acoustic- and PIT-tagged Juvenile Salmonids

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**Pacific Northwest  
National Laboratory**

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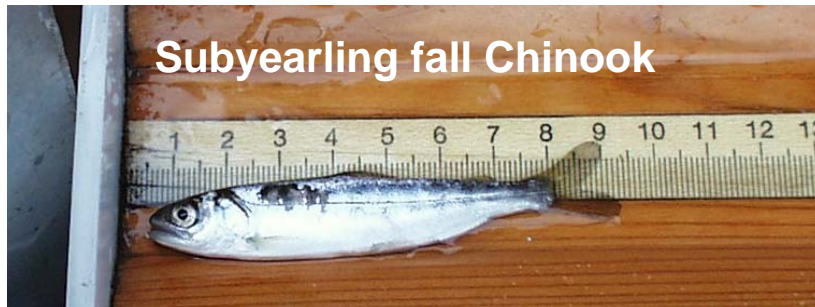


In the spring and summer of 2007, we conducted a comprehensive study to evaluate the effects of JSATS system 'micro'-acoustic tags on juvenile Chinook salmon migrating seaward through the Columbia River hydropower system.



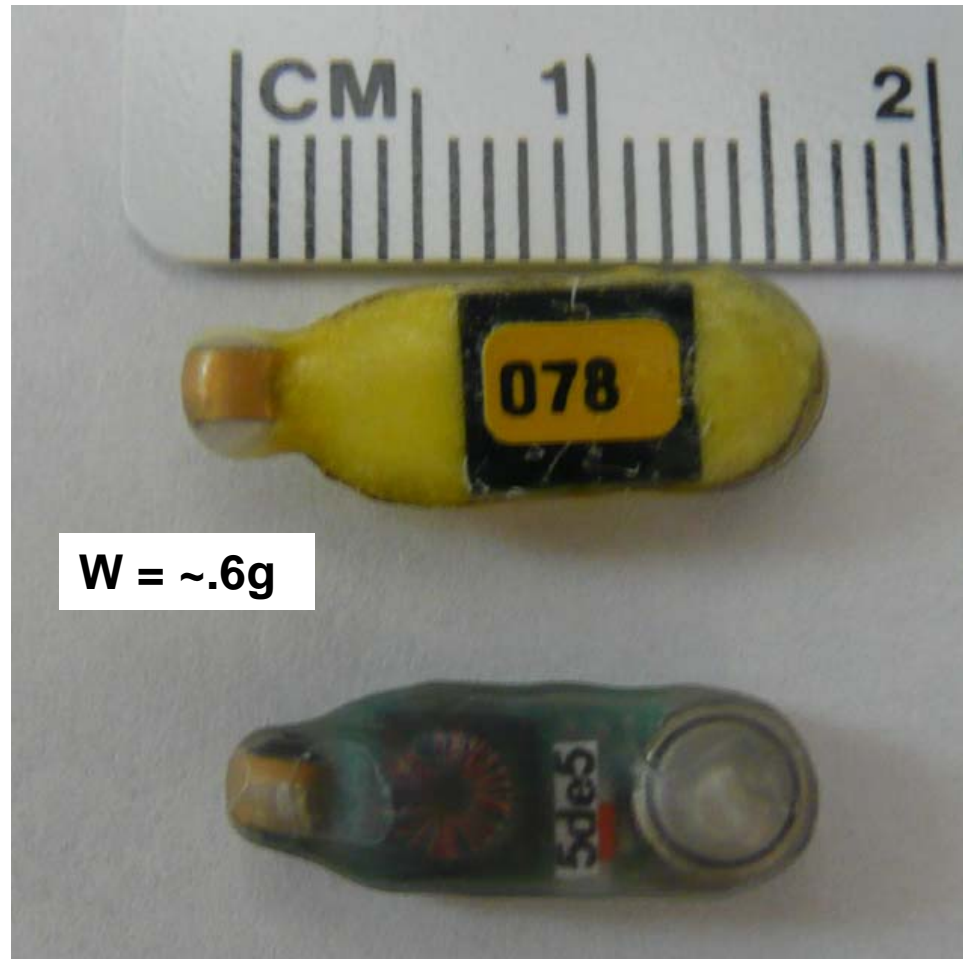
Hatchery spring Chinook

Avg. Tag Burden  
by FL = 133 mm W = 22.4  
by FL = 12% W = 3%



Subyearling fall Chinook

Avg. Tag Burden  
by FL = 107 mm W = 12.8 g  
(FL = 91 mm W = 7.5g  
by FL = 15% W = 4.7%  
(FL = 18% W = 8% pilot group)





## Objectives:

- To determine if survival differs between fish implanted with acoustic tags and fish implanted with PIT tags
- To determine if detection probabilities differ between fish implanted with acoustic tags and fish implanted with PIT tags
- To determine if travel times differ between fish implanted with acoustic tags and fish implanted with PIT tags
- If survival, detection probability or travel time differs between treatment groups, determine why?



**Pacific Ocean**

- **Spring & Summer 2007**

- **Implanted ~13,000 Chinook salmon with acoustic tags**

- **In conjunction with crew from Doug Marsh's 2007 Latent Mortality Study-implanted ~72,500 Chinook salmon with PIT tags**

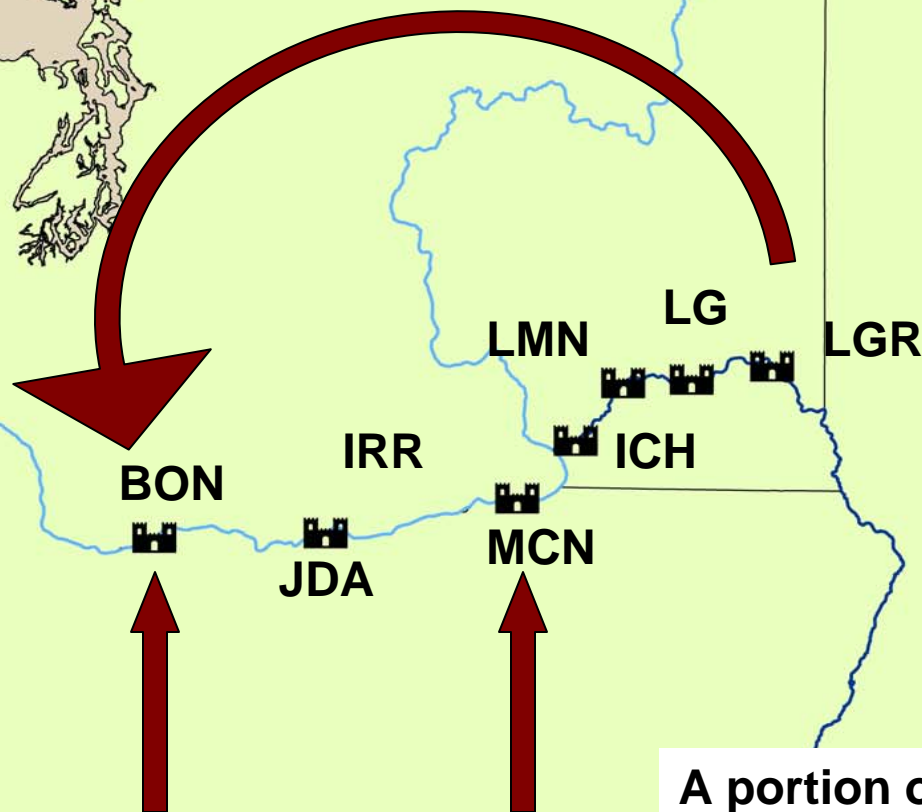
- **Released fish back into the river in the tailrace of LGD**

**SR fall Chinook ESU**

**SR Spring/Summer Chinook**

**ver**

Pacific Ocean



Survival  
system  
CJS Si

A portion of each  
release group was  
transported to the  
smolt-monitoring  
facility at Bonn for  
laboratory observation

of  
on





## **Sort-by-Code Necropsies:**

- A portion of each release/treatment group was intercepted at McNary Dam (spring fish) & Bonneville Dam (spring & subyearling fish) to evaluate fish condition post-tagging
- Baseline samples were obtained from study fish at Lower Granite Dam at the time of tagging
- Fish were weighed and measured and full necropsies were performed on them to evaluate tag loss, healing, tissue response to tagging, fish condition, BKD (based on ELISA)



## **Laboratory Holding:**

- **500 gal. circular tanks**
- **14 days in flow-through river water at ambient temperature**
- **76 days in artificial seawater (30 ppt) at 12-13°C**
- **Fish were monitored for tag loss and survival throughout holding**
- **At the end of the 90 day holding period, fish were euthanized, measured, weighed, and necropsies were performed on them to evaluate tissue response to tagging**
- **BKD ELISA assays were performed on kidney tissue from all laboratory fish after termination.**

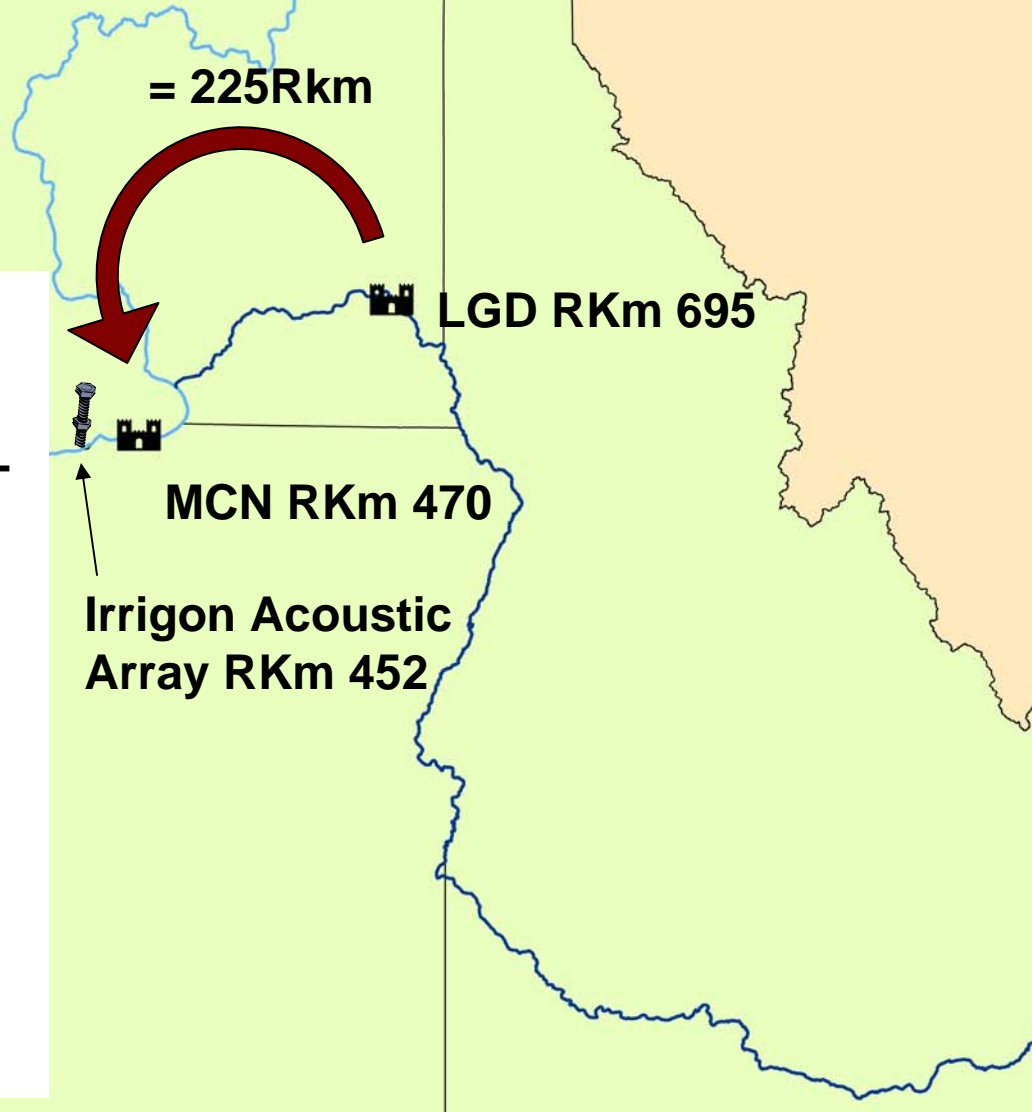






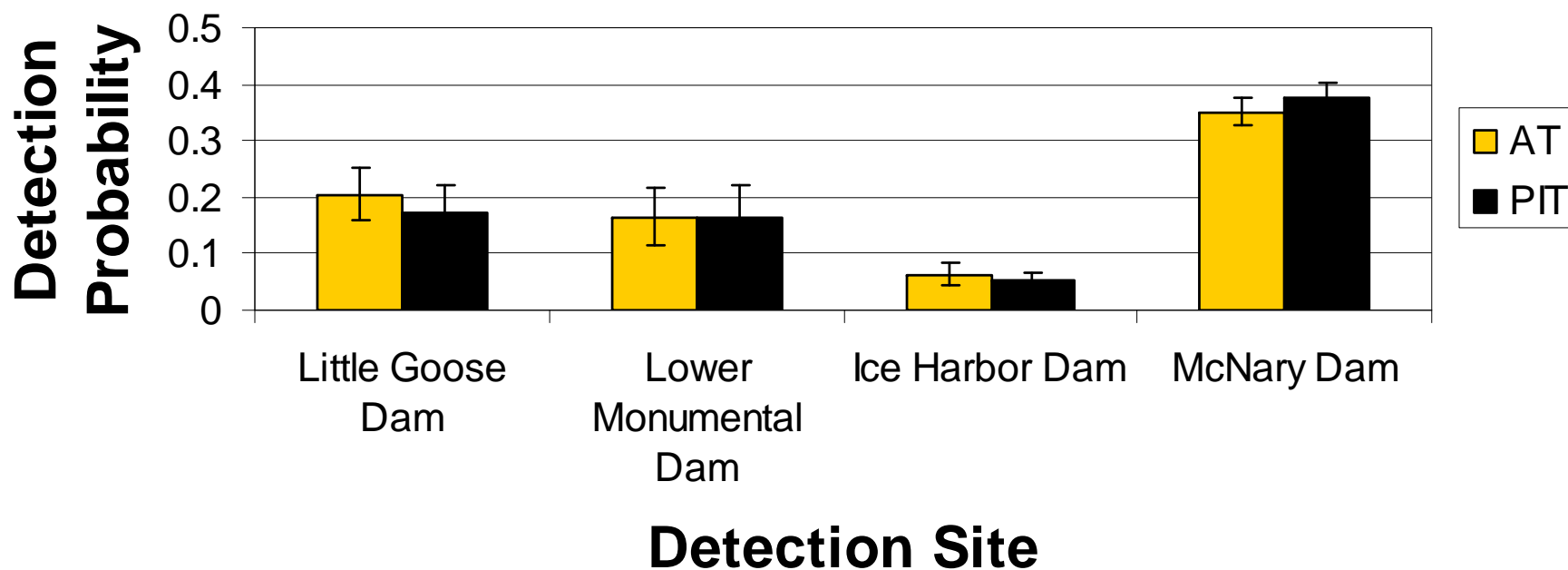
### **Spring Methods:**

- Tagged and released 3,380 AT Fish
- Tagged and released 46,782 PIT fish (Latent Mortality Study)
- 10 Days (April 24-May14)
- 40 fish per treatment/release (AT, PIT, Control) were transported to the lab at Bonneville and held 90 days
- 10 fish per treatment/release (AT, PIT) were targeted for necropsy by SbyC systems at McNary & Bonneville



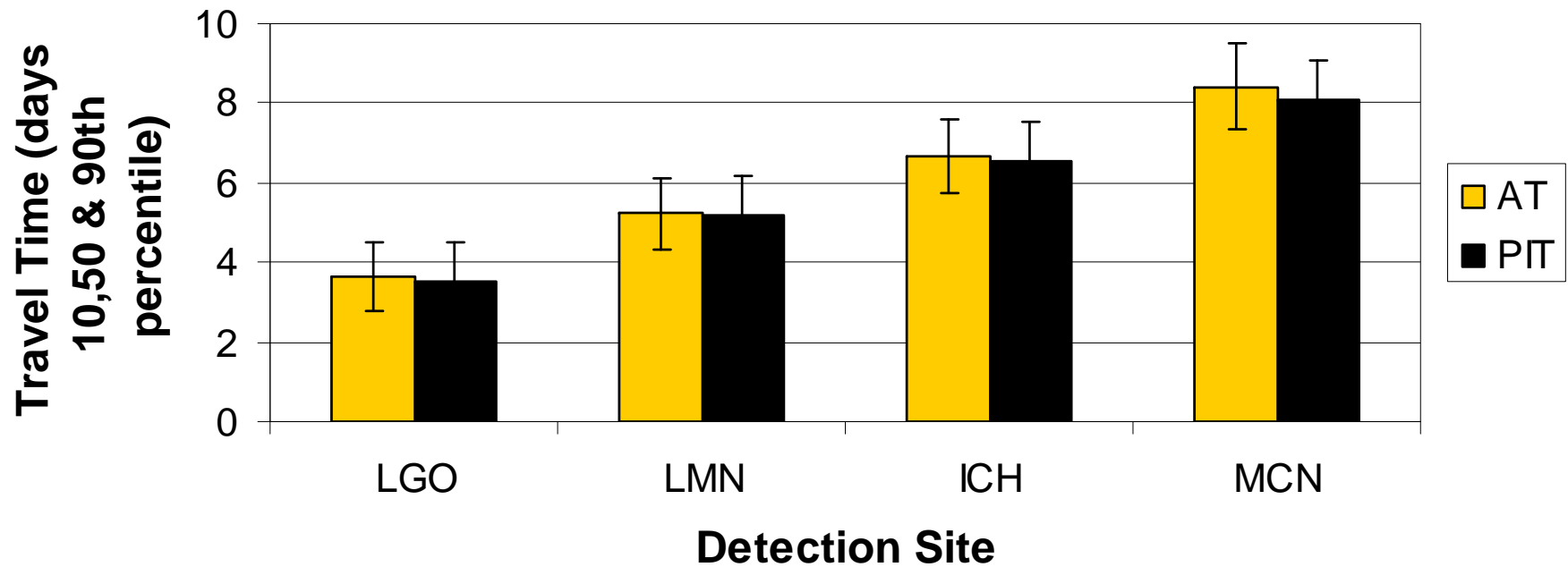


# Probability of being Detected at Downstream PIT Tag Detection Sites Spring Fish

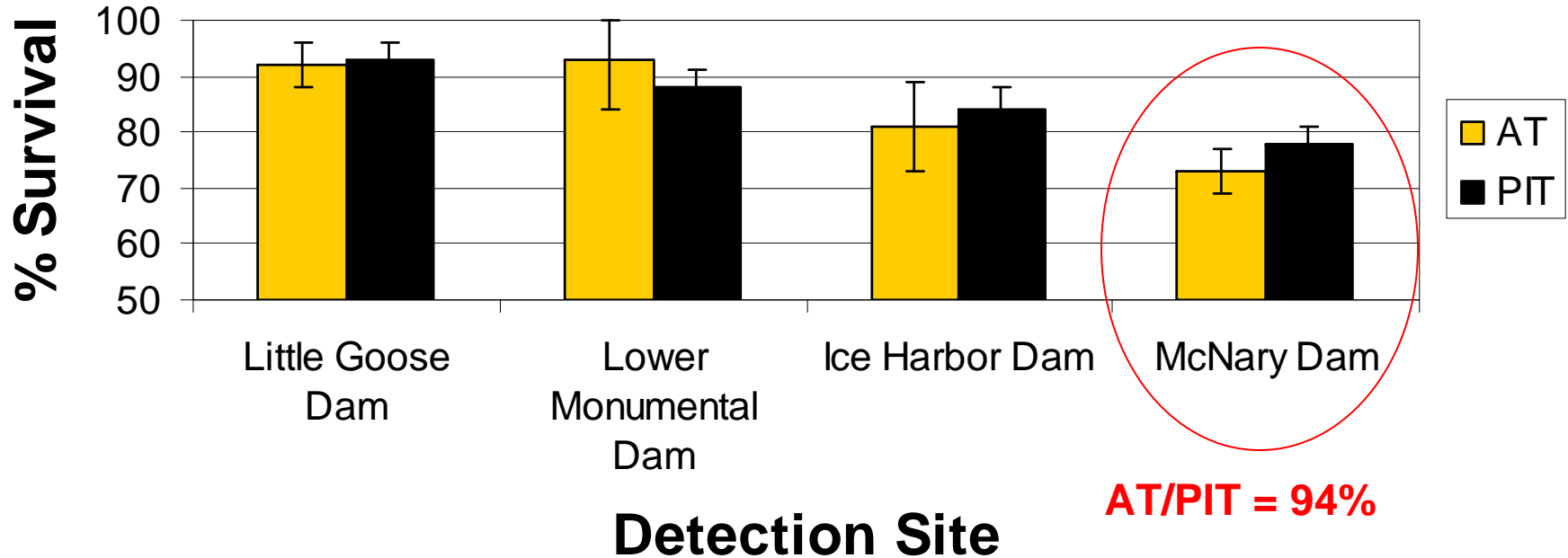




## Travel Time in Days From Release to Downstream PIT Tag Detection Sites Spring Chinook



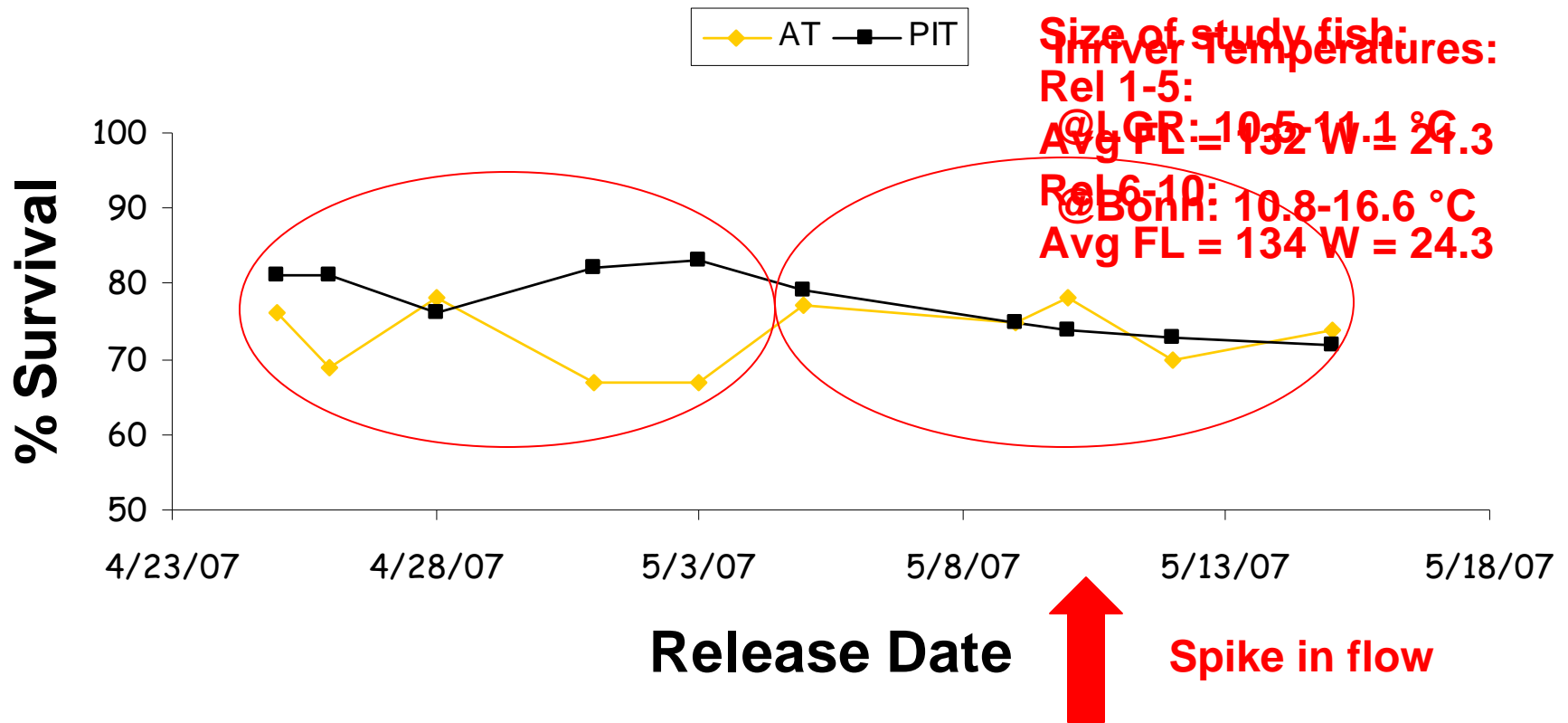
# Spring Chinook Inriver Survival From Release to Downstream PIT Detection Sites



**AT/PIT = 94%**

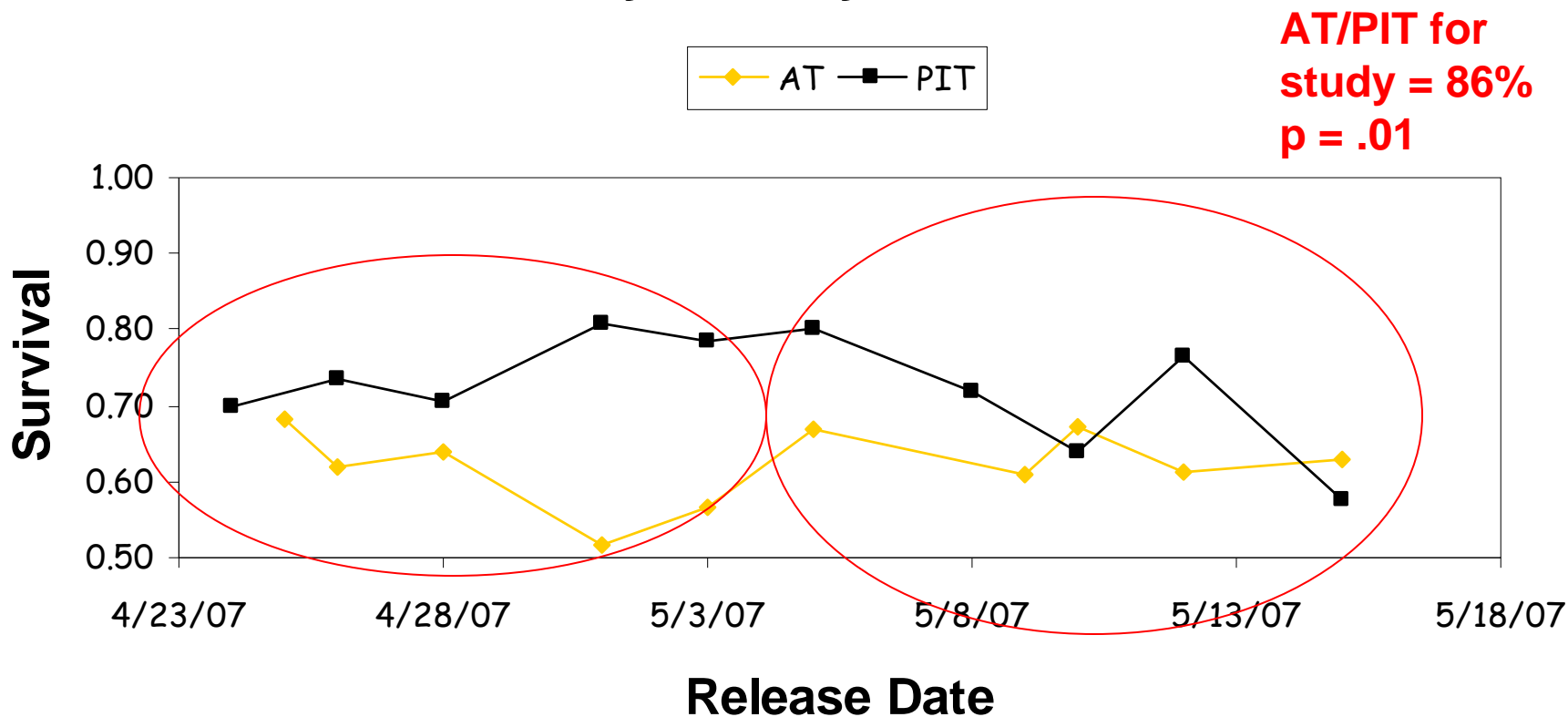
**P = .068, alpha = .10**

# Spring Chinook Survival from Lower Granite to McNary Dam by Release Date





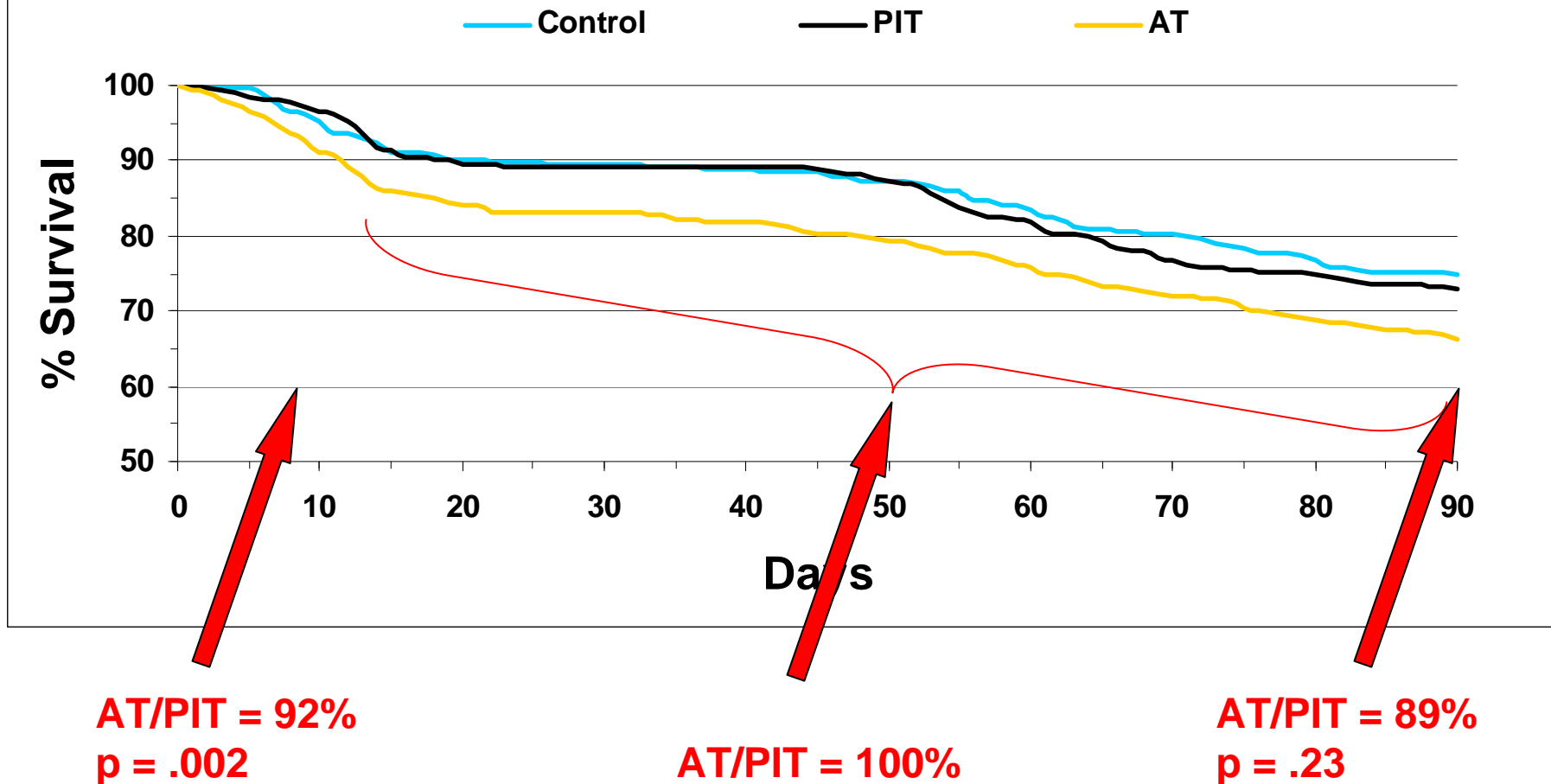
# Spring Chinook Survival from Lower Granite to John Day Dam by Release Date



AT/PIT =  
81%

AT/PIT =  
92%

# Spring Fish 90-Day Survival in Laboratory





## **Conclusions Spring Study:**

- **No significant difference in the probability of being detected between AT and PIT fish throughout the study area**
- **No significant difference in travel times between AT and PIT fish throughout the study area**
- **94% ( $p=.068$ ,  $\alpha = .10$ ) relative survival AT/PIT for study fish migrating in river to McNary Dam (total distance of 225 Rkm)**
- **Strong temporal component to difference in survival for migrating fish AT/PIT**
  - **Possibly due to differences in fish condition; size, weight, disease load and overall health**
  - **Differences in flow in river at time of tagging/migration**
- **Observed difference in survival in river supported by laboratory studies AT/PIT 92% ( $p=.002$ ,  $\alpha = .10$ ) at conclusion of freshwater holding phase**

# **Survival and behavior of subyearling Chinook salmon**

**Examined both using field studies and lab studies**

## **Field Studies:**

**Implantation of Acoustic transmitters in 9839 subyearling fall Chinook salmon**

**Released on 27 days between June 4 and July 13**

**2,092 fish  $< 95$  mm**

**7,739 fish  $\geq 95$  mm – focus of today's talk**

**Matched with 26,112 PIT tagged fish  $\geq 95$  mm**



# **Survival and behavior of subyearling Chinook salmon**

**Examined both using field studies and lab studies**

## **Laboratory Studies:**

**Transported to Bonneville Dam on 9 dates between June 4 and July 13**

**40 fish  $< 95$  mm AT & PIT**

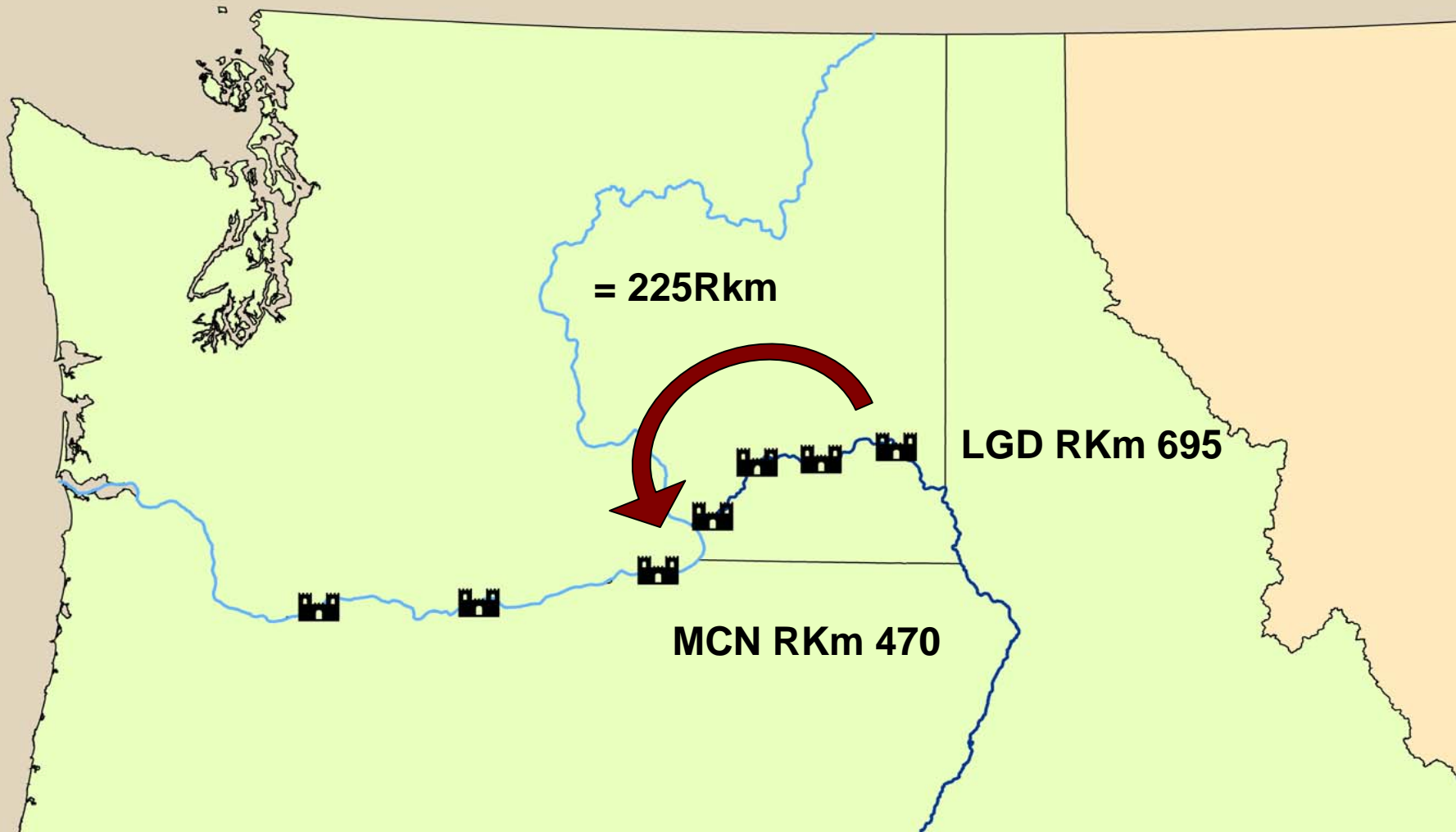
**40 fish  $\geq 95$  mm AT & PIT**

**40 fish  $\geq 95$  mm PIT**

**40 fish  $\geq 95$  mm control**

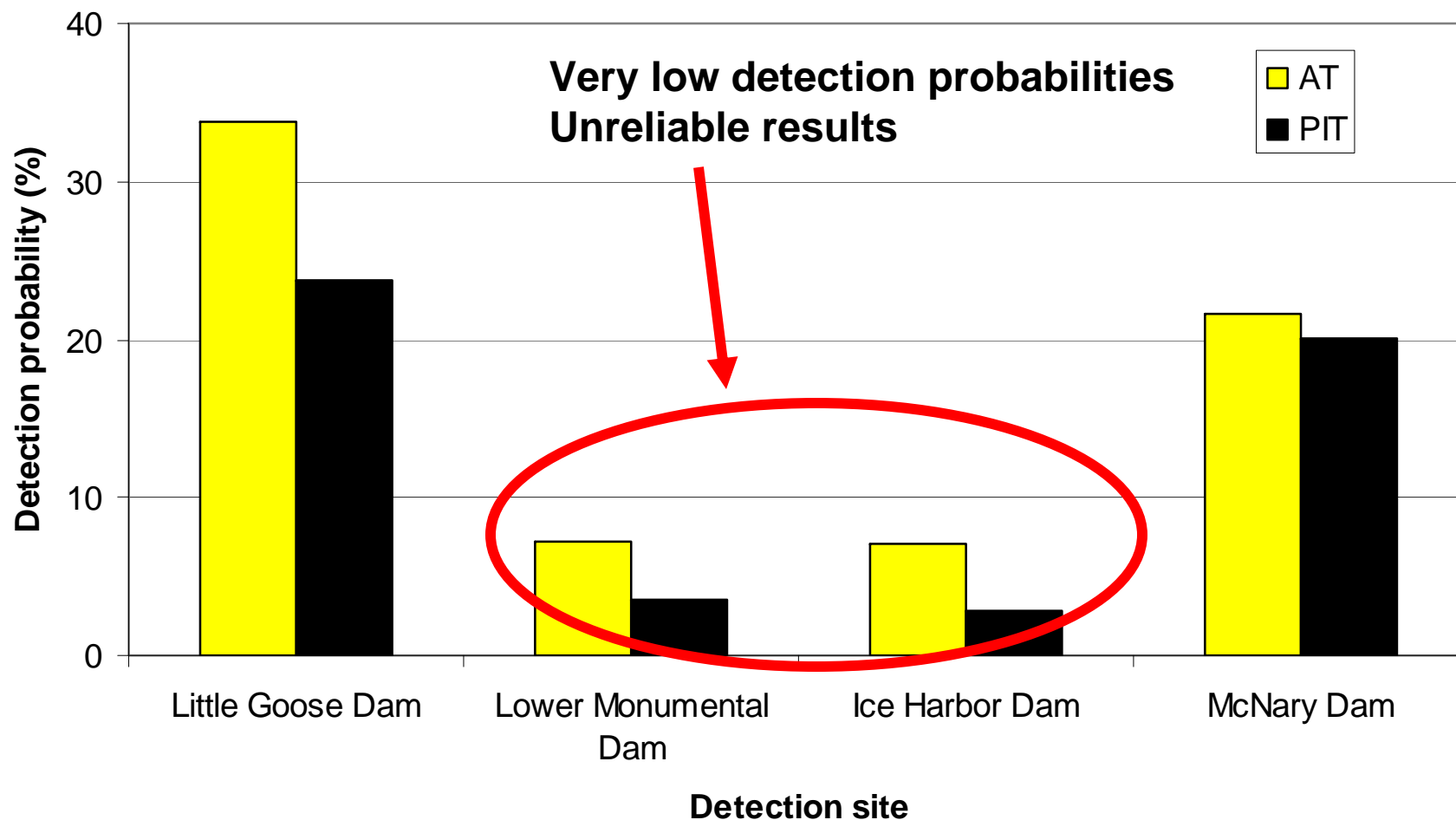
**Held for 90 days before necropsy**

# Survival and behavior of subyearling Chinook salmon was examined from Lower Granite Dam to McNary Dam



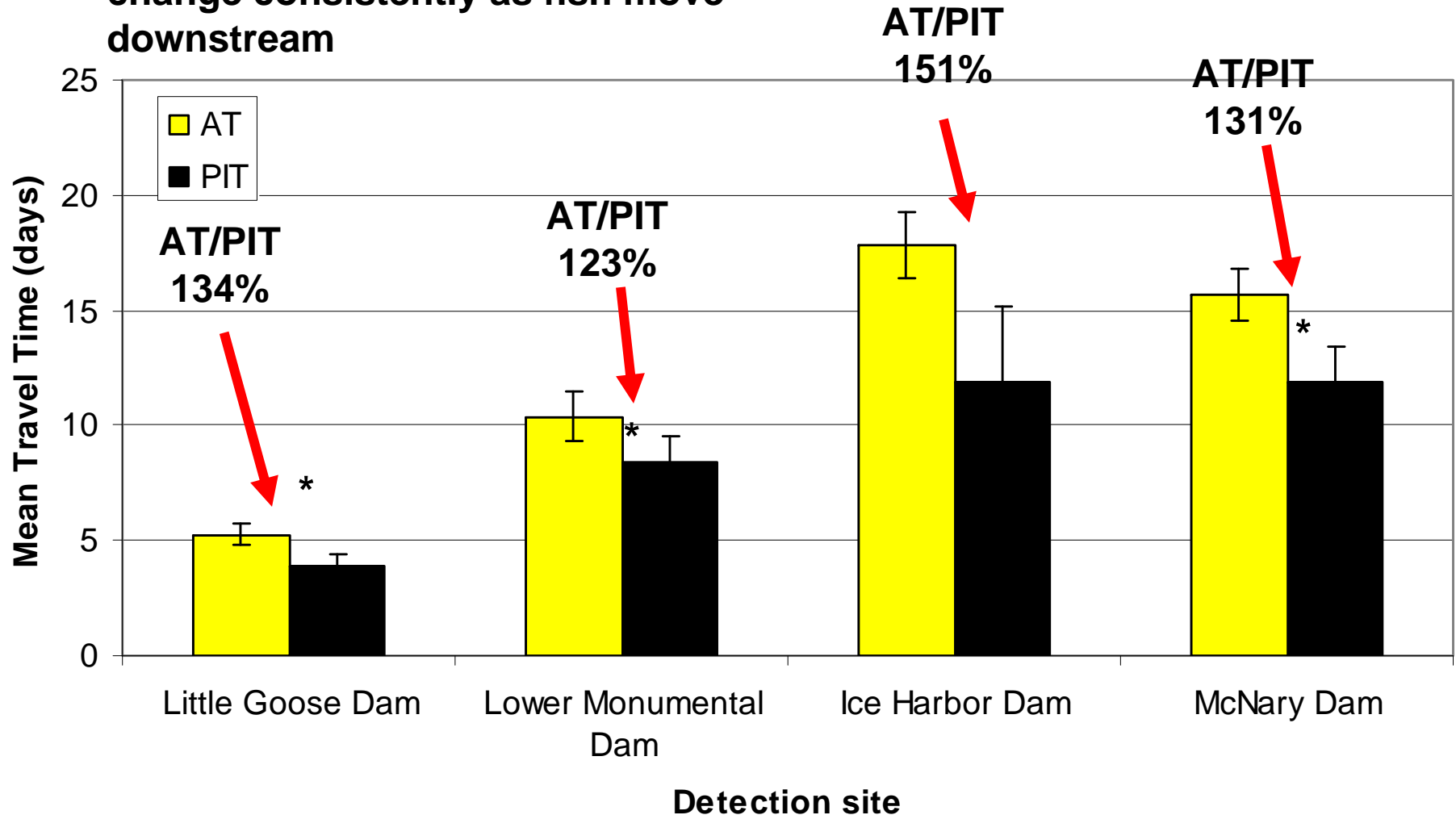
# Detection probability of PIT tags in test groups at downstream PIT tag detection sites

consistently  
higher for AT  
fish



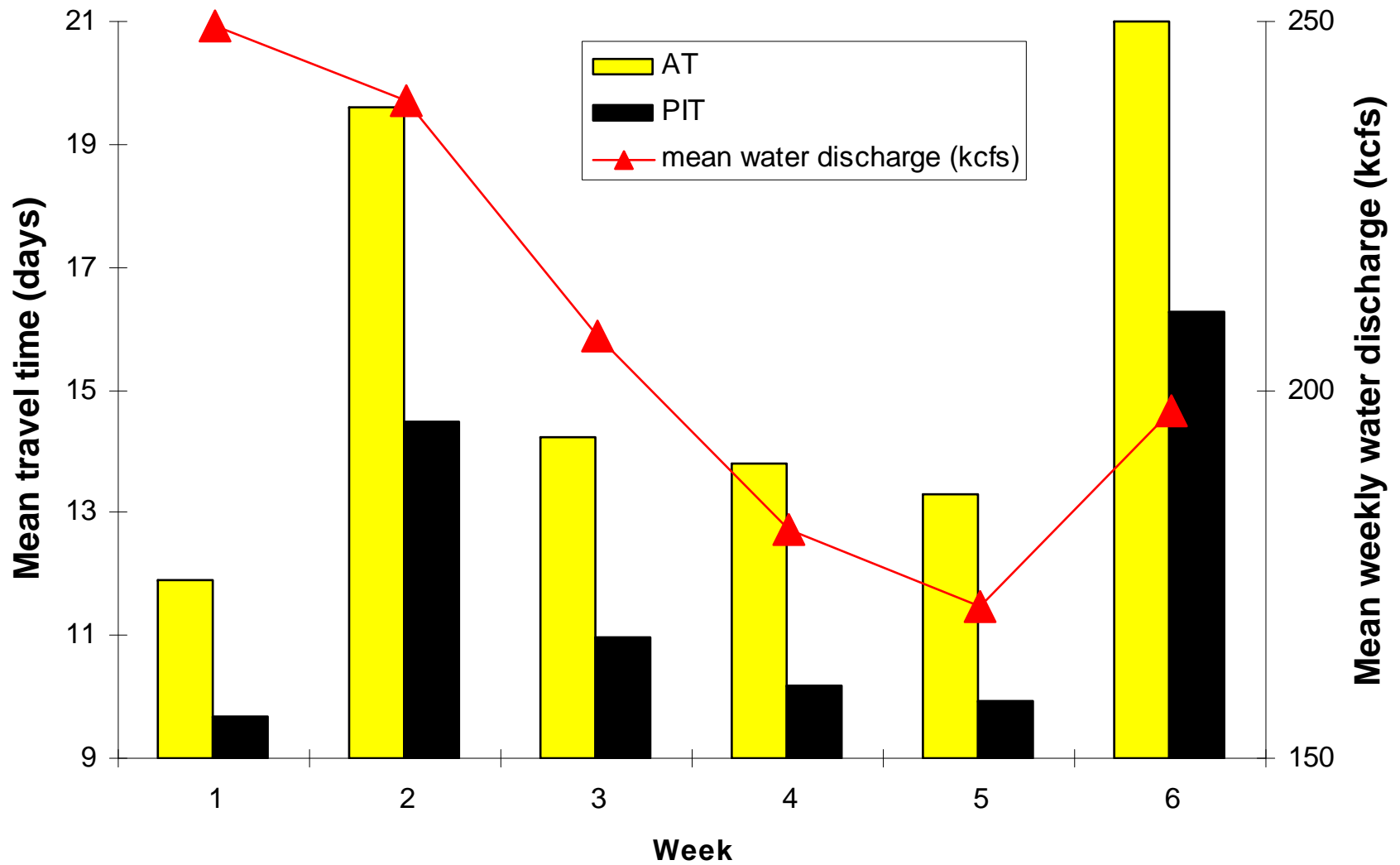
# Mean Fall Chinook Inriver Travel Time From Release To Downstream PIT Tag Detection Sites

Travel times are consistently slower for AT fish  
The differences between groups don't  
change consistently as fish move  
downstream

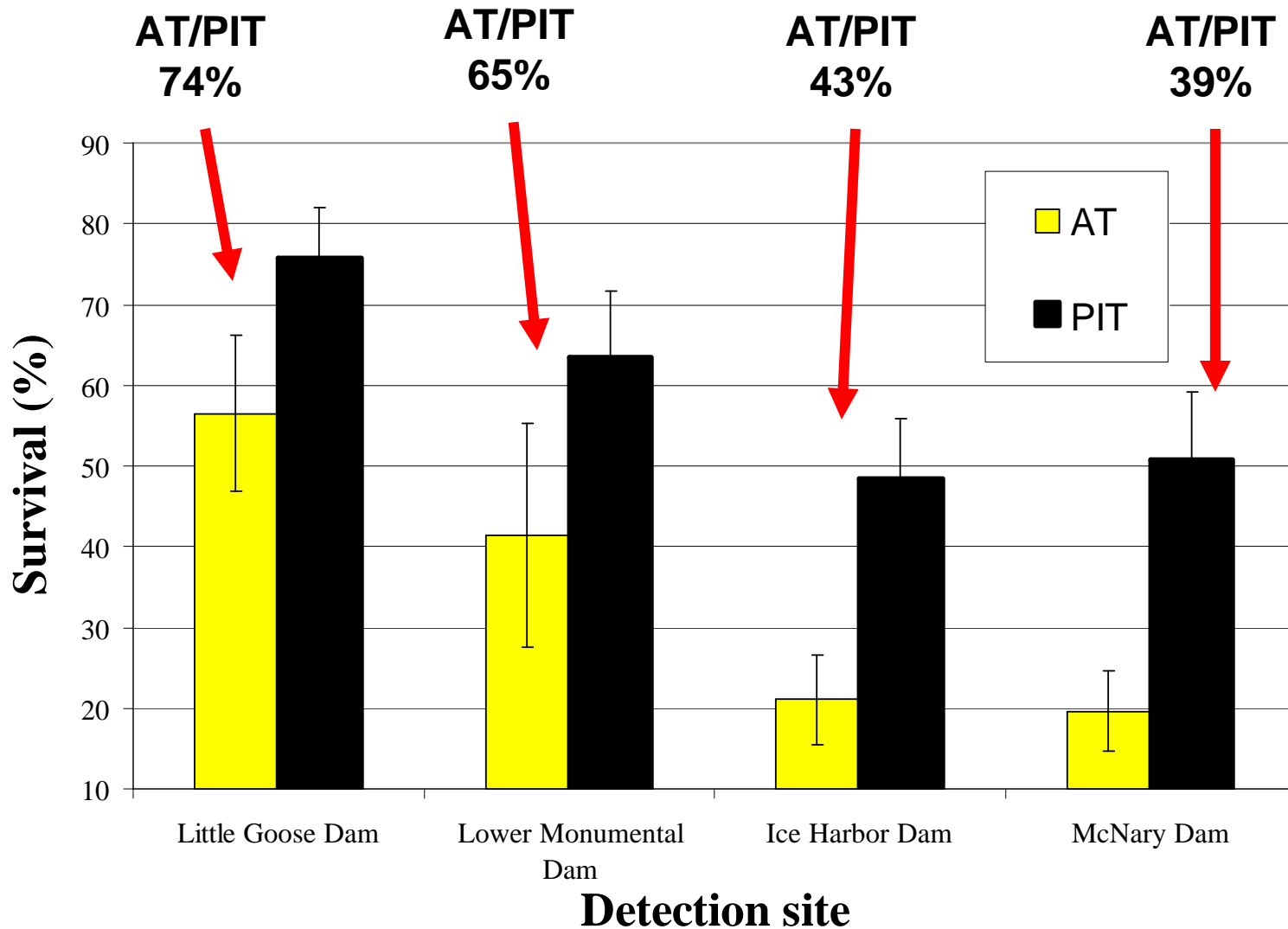




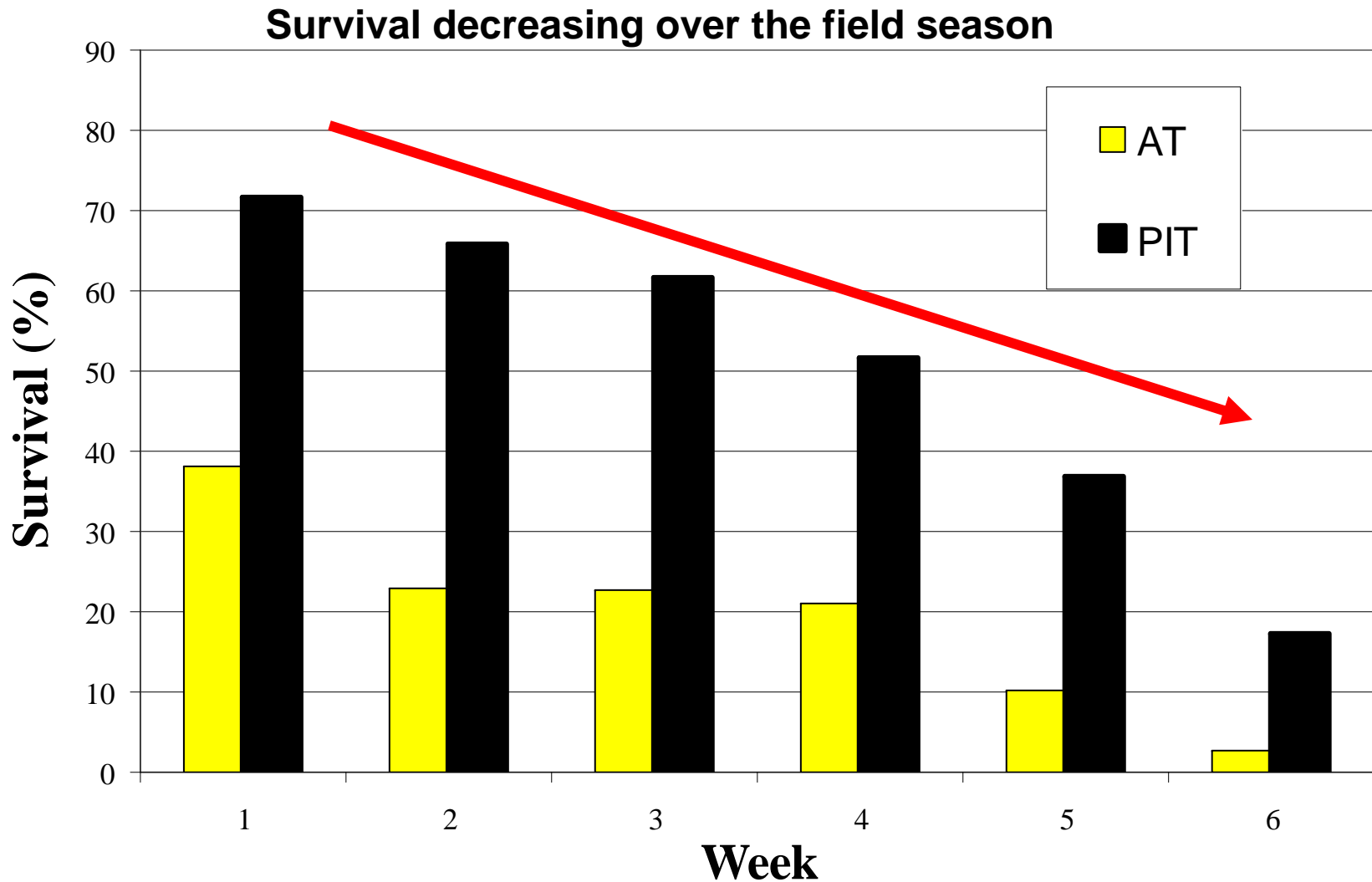
# Fall Chinook Inriver Travel Time From Release To McNary Dam



# Mean Fall Chinook Inriver Survival From Release To Downstream PIT Tag Detection Site



# Mean Fall Chinook Inriver Survival From Release To McNary Dam

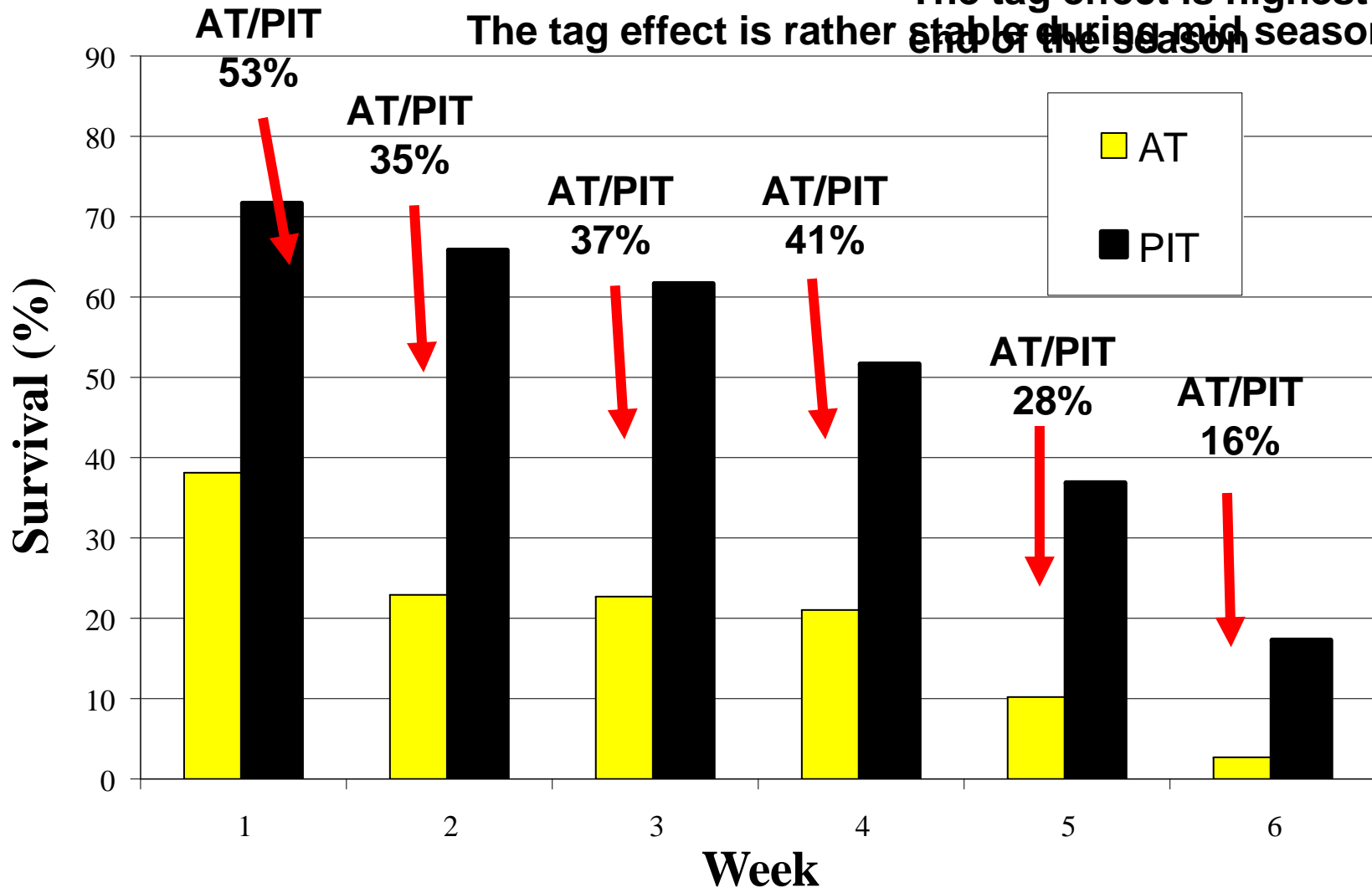


# Fall Chinook Inriver Survival From Release To McNary Dam

The tag effect is lowest during the early season

The tag effect is highest at the end of the season

The tag effect is rather stable during mid season

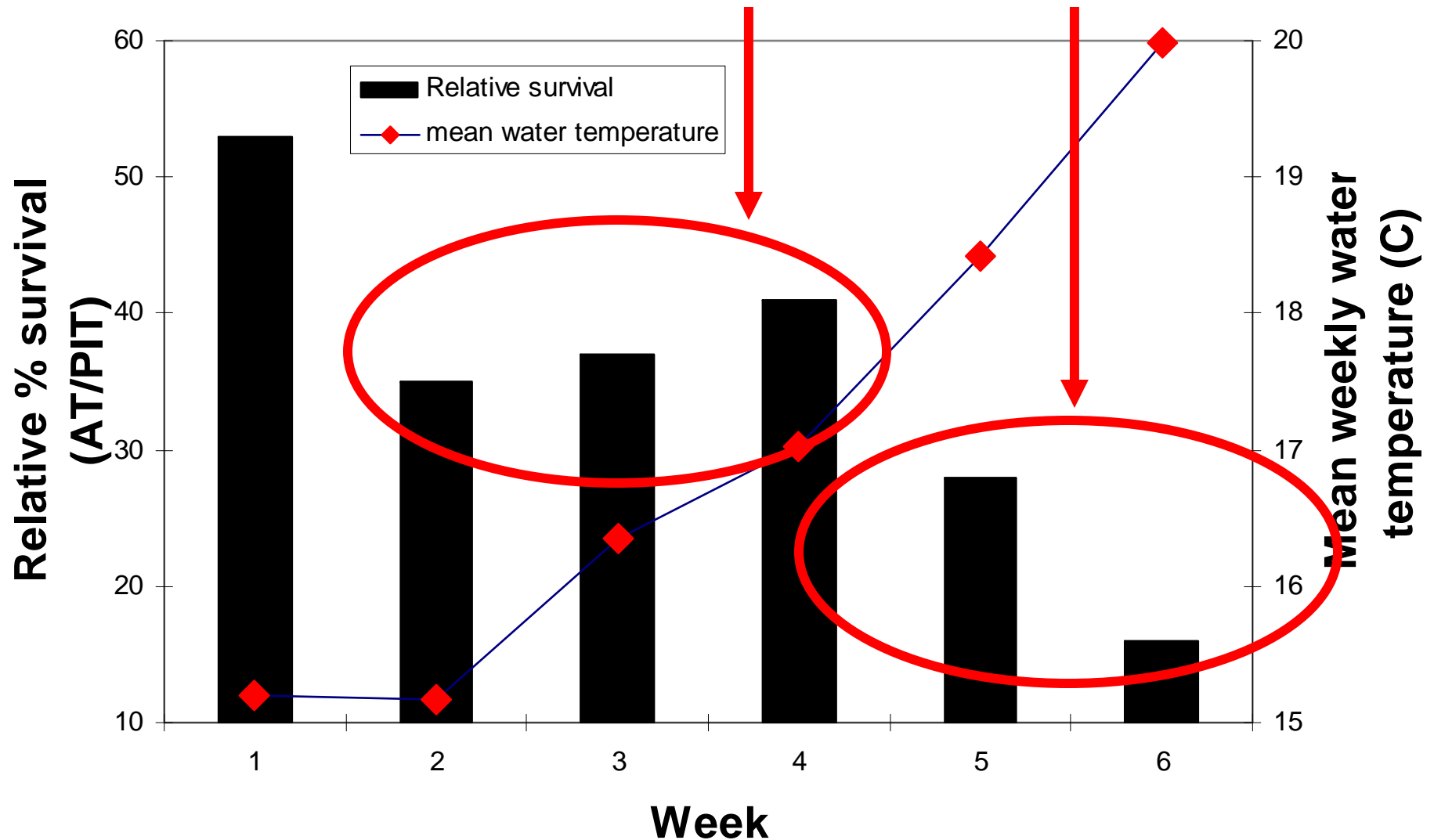




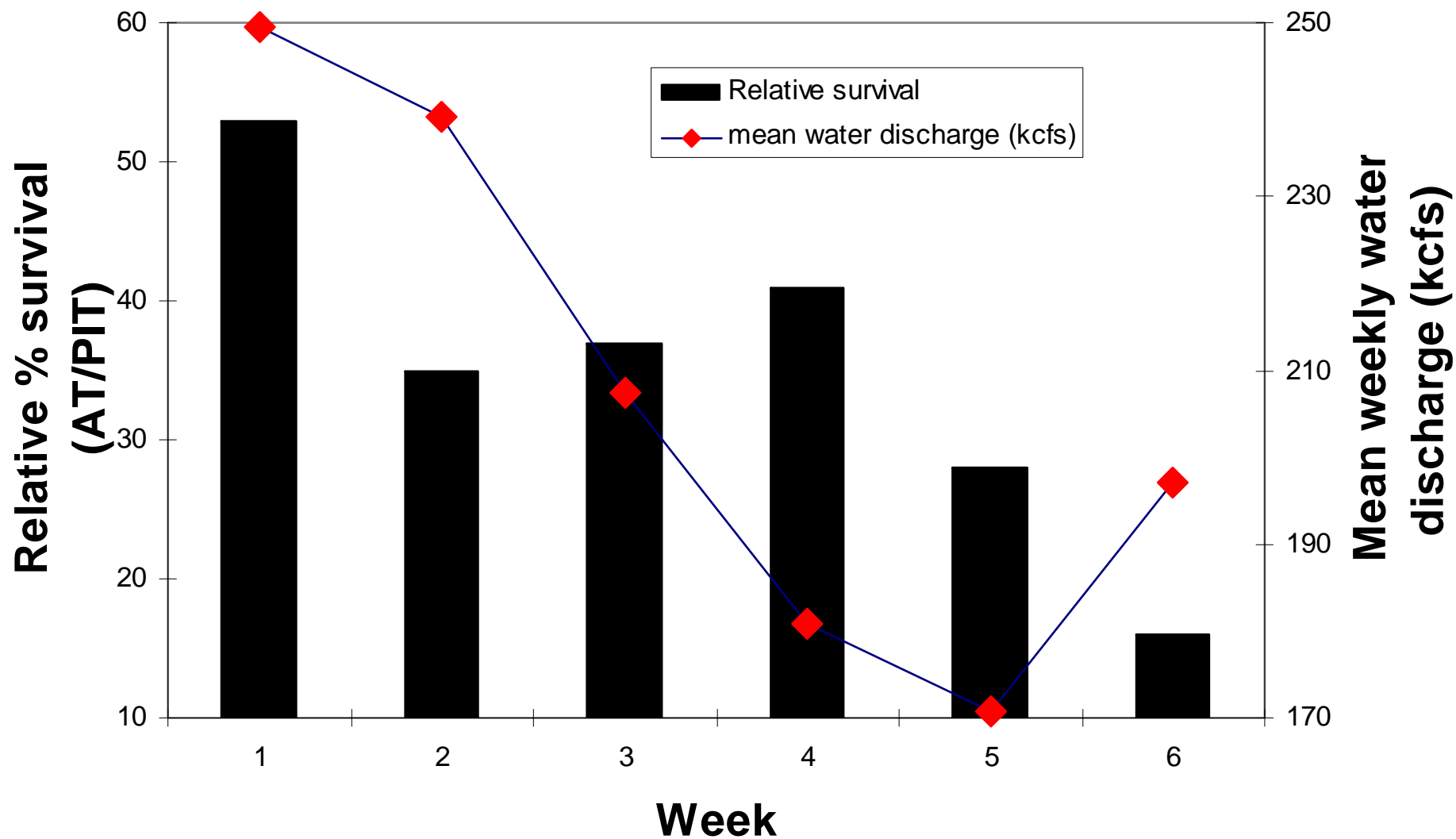
# Relative survival of AT vs PIT fish in relation to water temperature

Little difference in relative survival as water increases from 15 to 17 degrees

Large decrease in relative survival as water increases to 18-20 degrees

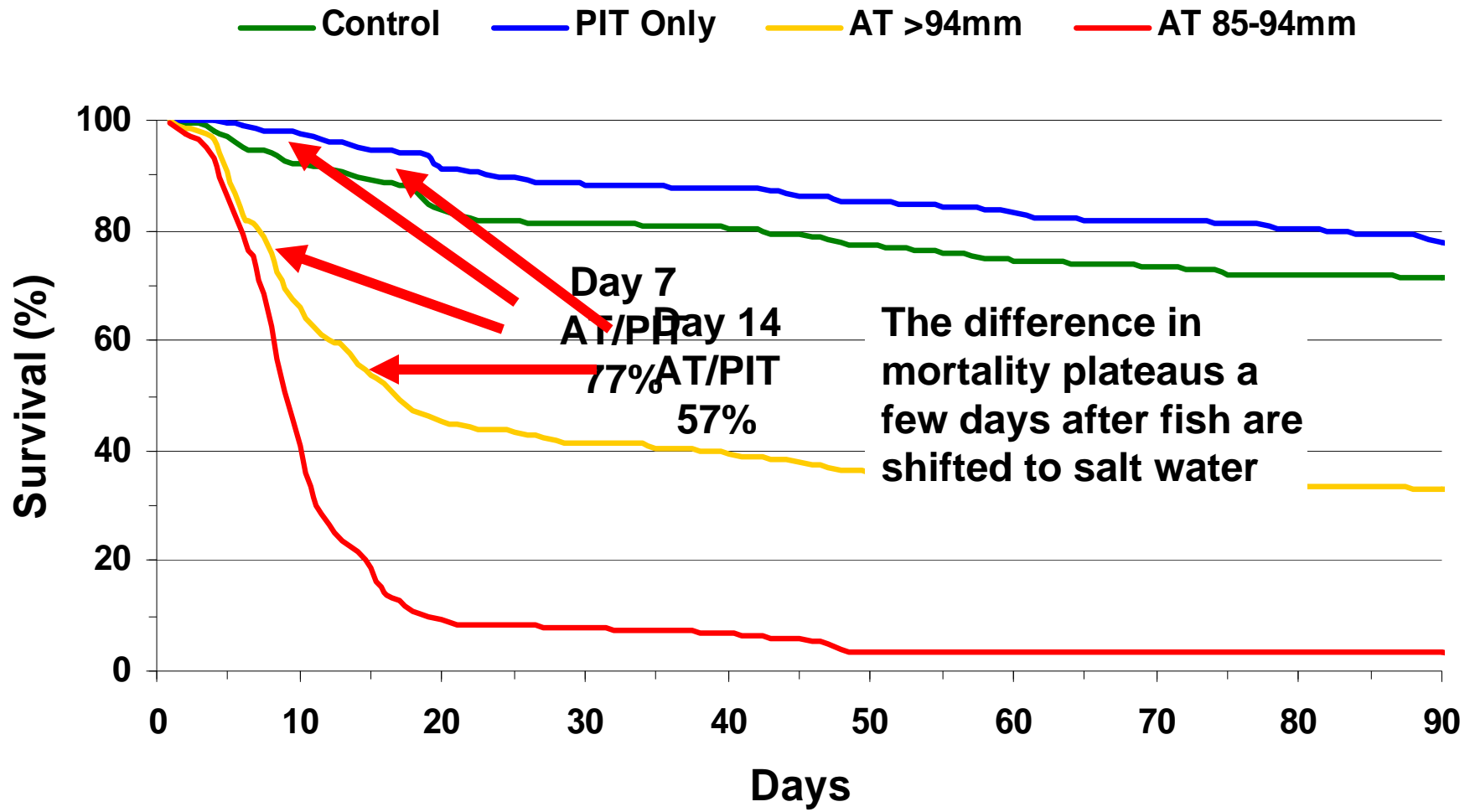


# Relative survival of AT vs PIT fish in relation to water discharge



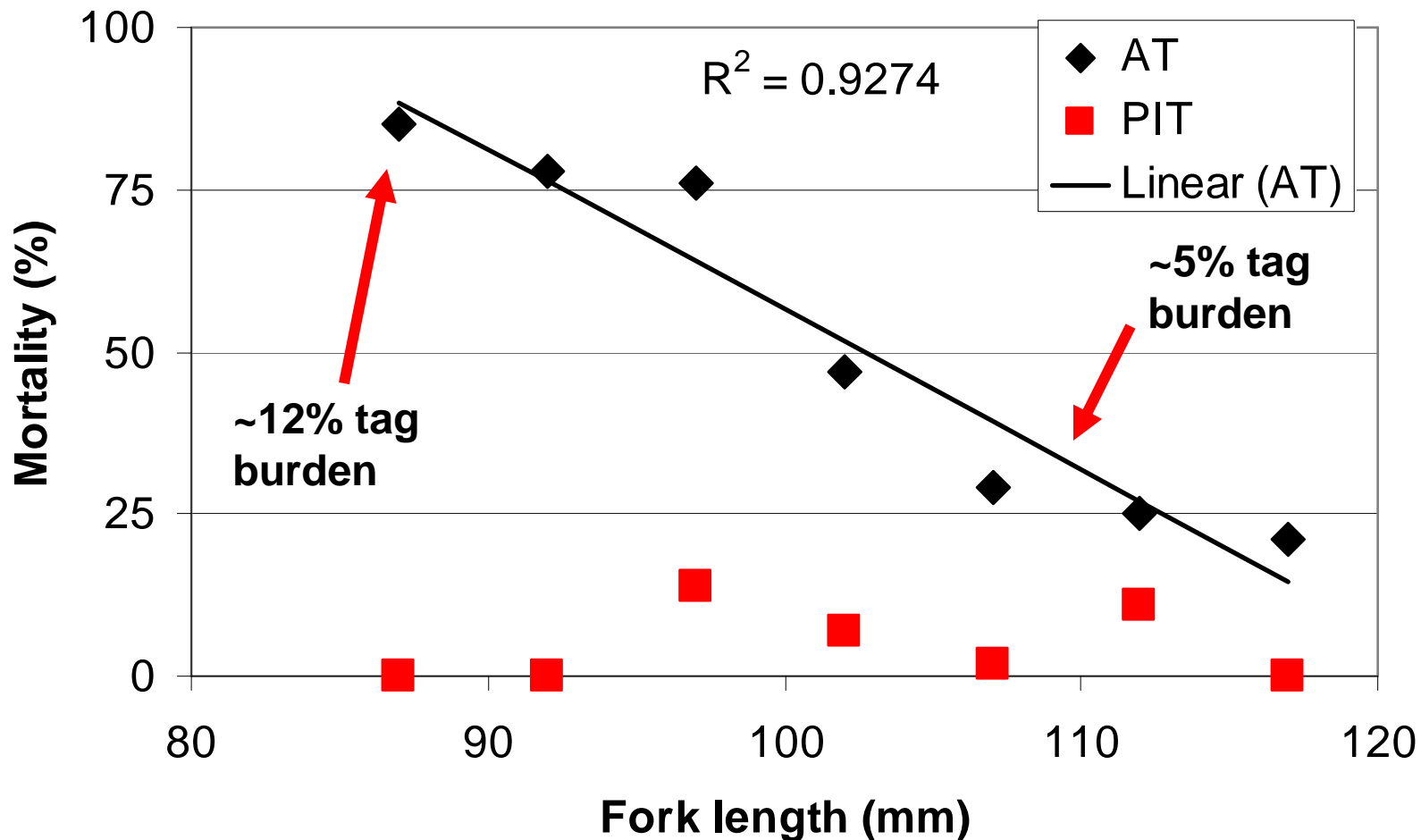
# Tag Effects Study 2007 - Subyearling Chinook Salmon

## 90-Day Survival in Holding



# Laboratory held fish

## Relationship between length and mortality



# **Conclusions**

**There was a significant tag effect within fall Chinook salmon (where)**

**The tag effect increased the farther downstream fish traveled**

**Survival decreased over the field season for PIT and AT fish**

**The tag effect increased over the field season and was positively correlated to water temperature**

**Travel time was slower for AT than PIT fish**

**Survival of fish in the lab reflected those in the field**

# **FY 08 Activities**

**Back off from field work**

**Continue lab work**

**Try to determine how much of the tag effect is due to the tag and how much due to tagging process**

**use sham tagged groups**

**test groups with smaller transmitters**

**Look at different treatments to improve survival of tagged fish**

**Fish treated with different antiseptic treatment (dips)**

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